Note on the Secular Perturbations of the Earth by Mars.
By R. T. A. Innes.

In my computation, printed in this volume on pages 80 to 87, I do not find for $\left[\frac{dp}{dt}\right]_{00}$ and $\left[\frac{dq}{dt}\right]_{00}$ the values given by Le Verrier in *Mémoires de l'Observatoire de Paris*, tome ii. Mr. Asaph Hall, Jun., has also performed the calculation by Gauss's method,* and finds for these functions practically the same values as computed by Professor Hill by algebraical expansion.† I therefore revised my figures, and not finding any material difference I examined the formulæ given in vol. i. of the *Astronomical Papers of the American Ephemeris*, with the result that I found a misprint in the value of J_3 on pages 338 and 359 For sin Π read sin Π'. My figures, altered accordingly, make J_3 so nearly the value found by Mr. Hall that it is needless to finish the calculation.

It will be interesting to compare the values of the secular perturbations of the Earth caused by *Mars* found by Le Verrier and Professor Hill by expansion with those found by Gauss's method by Mr. Hall and myself. Reducing all to the mass of *Mars* used by Mr. Hall, viz. $\frac{1}{m'} = 3093500$, we have—

$\left[\frac{de}{dt}\right]_{00}$	$-0''.015723$ Hall.	$\left[\frac{d\pi}{dt}\right]_{00}$	$+0''.975139$ Hall.
	-0.015734 Le Verrier.		$+0.975430$ Le Verrier.
	-0.015722 Innes.		$+0.975224$ Innes.
$\left[\frac{dp}{dt}\right]_{00}$	$+0.006344$ Hall.	$\left[\frac{dq}{dt}\right]_{00}$	-0.007195 Hall.
	$+0.006336$ Hill.		-0.007211 Hill.
	$+0.006351$ Le Verrier.		-0.007209 Le Verrier.

$\left[\frac{dL}{dt}\right]_{00}$	$0''.23424$ Hall.
	0.23368 Le Verrier.
	0.23469 Innes.

Erratum in my previous communication:—

$$\text{Page 81, read } \nu' = \frac{\sqrt{3}}{32\, m_{,}^{2}}\left\{1 + 2\frac{\lambda^4}{m_{,}^{2}m_{,,}^{2}} + 4\frac{\lambda^{12}}{m_{,}^{6}m_{,,}^{4}m_{,,,}^{2}} + \&c.\right\}$$

There are a few other misprints, but they are of no importance.

The second part of the expression for J_3 on page 81, and J_3 and $\frac{a}{r}W_0$ on page 85, are incorrect for the reason pointed out above.

* *Astronomical Journal*, vol. xi., No. 4, July 24, 1891.
† *Astronomical Papers of the American Ephemeris*, vol. iv., pp. 511–12.

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On a New Form of Altazimuth. By W. H. M. Christie, M.A., F.R.S., Astronomer Royal.

The altazimuth proposed is a reversible transit-circle with iron stand, capable of being placed in different definite azimuths, say 0°, 20°, 40°, 60°, 75°, 90° E. or W. of the meridian, the instrument being used as a transit-circle in any one of these azimuths. This may be arranged by mounting the iron supports of the transit-circle on a circular base resting at three parts of its circumference on a circular casting carefully planed on its upper surface and bolted to the foundation pier. By the help of friction rollers, brought into action to take off part of the weight, the transit-circle could be rotated round a central pivot from one definite azimuth to another, suitable arrangements being made for locking it firmly in the required position, as in the case of a railway turntable. In fact, the transit-circle would be mounted on a turntable with provision for bringing it into definite azimuths and for securing its fixity when brought into position. The proposed altazimuth would thus be essentially a transit-circle capable of being used out of the meridian, in the prime vertical or in any other selected azimuthal plane. It would differ in principle from the well-known form of transit-instrument in the prime vertical, as the zenith-distance of the object would be observed (by means of the vertical circle) as well as the time of azimuthal transit, and a complete determination of the position of the object (R.A. as well as N.P.D.) would be made by a method of observation and reduction essentially different, and applicable in any azimuthal plane.

The principle of the method of observing would be that the observations of azimuth and zenith-distance should be referred to the same instant of time and that from these the R.A. and N.P.D. would be deduced subject to corrections for the instrumental errors of collimation, level and azimuth (difference from assumed azimuth).* The computations would thus be greatly simplified, and tables could be readily formed for the given azimuths of auxiliary quantities which would render the reductions very easy.

Transits should be taken over vertical wires (say two sets of five, omitting the central wire), and over horizontal wires (say two sets of five, omitting the central wire) arranged so that, generally, the horizontal and vertical transits would not interfere with each other, and that the mean of the time of transits over the vertical and horizontal wires respectively would differ only by a small quantity. This condition may be secured by having in addition to the systems of vertical and horizontal wires (each carried on a micrometer slide as usual in a transit-circle) a wire

* The observed Z.D. and time of transit might be corrected for the effect of errors of collimation and level before the computation of N.P.D. and R.A., but the corrections would, I believe, involve a little more labour.